1600EP Single Phase Uninterruptible Power Supply Systems
Guide Specifications
3.6, 6.0, 8.0, 10.0, 14.0, 18.0, 22 kVA

1.0 Scope

This specification describes the requirements for an On-Line Uninterruptible Power Supply (UPS). The UPS will supply a computer grade AC output sinewave which is unaffected by the quality of the AC input. The input voltage is single phase and the output voltage is single phase.

2.0 General Operation

Under normal operating conditions, the UPS's rectifier converts alternating current (AC power) to direct current (DC power), which is required for the system's inverter and battery charger. The charger supplies regulated DC power to keep the batteries constantly charged. The inverter uses pulse width modulation (PWM) that fully utilizes the characteristics of insulated-gate bipolar transistors (IGBT) to convert DC power to regulated AC power. Therefore there is a constant supply of power. The batteries will instantaneously supply the inverter DC power should an AC power line failure occur.

2.1 Performance Standards

The UPS shall be designed with the applicable sections of UL, CUL, and ISO 9001 14001. The UPS shall have UL and CUL listing.

3.0 General

3.1 Materials

All materials used are of new manufacture using the latest technology and should not have been in prior service except for specified factory testing. IGBT's (insulated-gate bipolar transistors) are used exclusively in inverter and chopper sections.

3.2 Components

All functioning components are solid state with no moving parts.

3.3 Installation

The installation of the UPS must comply with the UPS manufacturer's recommendations that will be supplied before delivery of the UPS. Local electrical codes and the National Electric Code must be complied with. All wiring must comply exactly with what is specified.

3.4 Assembly

The UPS shall be delivered fully assembled and be fully functional.

4.0 System Theory and Operation

4.1 Theory

AC input from the utility system is converted into DC power chopper. The stepped up DC power is then converted to AC power by the inverter. The output voltage waveform of the inverter will be the pulse voltage waveform modulated by the PWM control using the 14 kHz switching frequency sinewave. The PWM-Modulated voltage waveform is transformed into a sine voltage waveform by the inductive component of the inverter inductor and by the capacitive component of the capacitor filter. The chopper, inverter,

and charger use the IGBT with a self-extinguishing function and a high switching speed. On the output there is an isolation transformer for extra power conditioning.

4.2 Modes of Operation

4.2.1 Emergency (Battery Backup)
In the event the AC power from the utility system fails, the DC power is supplied from the batteries to the chopper and to the inverter to provide a continued and stable AC power supply to the load without interruption.

4.2.2 Normal (Inverter)
The rectifier converts AC to DC to power the inverter, which supplies power to the critical load and simultaneously float charging the batteries.

4.2.3 Battery Charge
The charger will float charge the batteries while no load is being powered by normal mode.

4.2.4 Static Bypass
If the UPS unit is in severely overloaded or develops an internal fault, power is automatically switched from the units main circuit to the bypass circuit. Power is conditioned by line filters, and the isolation transformer during static bypass operation.

5.0 UPS Input

5.1 System Rating The UPS's are sized to supply a load with a power factor of 0.85.
Sizes: 3.6, 6.0, 8.0, 10.0, 14.0, 18.0, 22.0 kVA

5.2 Electrical Requirements
Voltage: 240/208 VAC Single Phase

Voltage Range: 168V~264V (+10% to -30%)

Frequency: 50 or 60 Hz (45-65 Hz)

Synchronization: ±3Hz

Power Factor: Greater than 0.95

Input Total Harmonic Distortion: Less than 5% (current)

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6.0 UPS Output

Voltage: 240/208/120 VAC Single Phase

Capacity:

kVA	kW (@ 0.85PF)
3.6 kVA	3.1 kW
6.0 kVA	5.1 kW
8.0 kVA	6.8 kW
10.0 kVA	8.5 kW
14.0 kVA	11.9 kW
18.0 kVA	15.3 kW
22.0 kVA	18.7 kW

Regulation: +/-3% (with AC power and during battery backup)

Distortion: Less than 6% THD at Full Non-Linear Load
Less than 3% THD at full Linear Load

Step Load: ± 8 % max from 100% to 0 % or from 0% to 100 % linear load

Output Current:

kVA	RMS	PEAK
3.6	15.0A	45.0A
6.0	25.0A	75.0A
8.0	33.3A	100.0A
10.0	41.6A	125.0A
14.0	58.0A	174.0A
18.0	75.0A	225.0A
22.0	91.6A	275.0A

Overload Capacity (Inverter): 150% for 10 seconds
125% for 30 seconds
1000% for 1 cycle

Crest Factor: 3.0

Frequency: 50/60Hz Auto Sensing

Regulation: ± 0.5Hz / ±1.0Hz / ±1.5Hz (authorized service center selectable only)

Synchronous Range: +/- 1 Hz

Wave Form: Sine wave, Zero Transfer Time

Load Power Factor: 0.85 lagging (0.6 to 1.0)

Efficiency AC to AC: Greater than 83%

Noise Isolation: Neutral is bonded to ground on the output of the Isolation transformer for isolation of common mode
Bypass: Manual bypass provided with switch with less than 4 ms transfer

7.0 UPS Battery

Battery Bus Volts:

3.6 kVA	216 VDC nominal
6.0 kVA	216 VDC nominal
8.0 kVA	288 VDC nominal
10.0 kVA	288 VDC nominal
14.0 kVA	288 VDC nominal
18.0 kVA	288 VDC nominal
22.0 kVA	288 VDC nominal

Backup time:	0.7PF	0.85PF
3.6 kVA	14 minutes	10 minutes
6.0 kVA	7 minutes	7 minutes
8.0 kVA	7 minutes	7 minutes
10.0 kVA	5 minutes	5 minutes
14.0 kVA	7 minutes	7 minutes
18.0 kVA	5 minutes	5 minutes
22.0 kVA	5 minutes	5 minutes

Type of Battery: Enersys NPX-35 Flame Retardant Lead Acid 9Ah/12V
Number of Battery: Six batteries in each pack
Average Recharge: 24 hours (12 hours for 90%)

Battery Voltage Range:

3.6 kVA	170 – 245.7 VDC
6.0 kVA	170 – 245.7 VDC
8.0 kVA	227 - 327 VDC
10.0 kVA	227 - 327 VDC
14.0 kVA	227 - 327 VDC
18.0 kVA	227 - 327 VDC
22.0 kVA	227 - 327 VDC

Cutoff Voltage: 1.6 Volts per cell

Heat Generation	kVA	BTU / Hour
	3.6	1588
	6.0	2610
	8.0	3482
	10.0	4352
	14.0	6092
	18.0	7832
	22.0	9600

8.0 System Status and Control Indicators

8.1 Panel

The UPS shall have a panel on the front for complete monitoring control of UPS.

Operation panel features:

1) Run/Stop button
2) AC input voltage indicator
3) Inverter status indicator
4) Alarm indicator
5) Fault indicator
6) Liquid Crystal Display (LCD)

The UPS shall have menu driven LCD that displays operating conditions, warning messages and fault indication messages for the unit.

Operating Conditions Display:

1) Input voltage
2) Output voltage
3) Input frequency
4) Output frequency
5) Output current
6) Battery voltage
7) Battery test results
8) Output voltage adjustment
9) UPS ON/OFF Line

Warning messages:

1) Overload
2) Current limit
3) Emergency power off
4) Battery discharge
5) Battery Low
6) Input undervoltage
7) Battery not good

Fault Messages:

1) DC undervoltage
2) DC overcurrent
3) DC overvoltage
4) Overheat
5) UPS overload
6) Inverter undervoltage
7) Inverter overvoltage

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9.0 Dimensions

	3.6 kVA	6.0 kVA	8.0 - 10 kVA	14 - 22kVA
Weight	322 lbs	346 lbs	476 lbs	784 lbs
Depth	28”	28”	28”	39"
Width	10”	10”	13”	18"
Height	33”	33”	34”	35"

Casters and leveling feet are standard

10.0 Communications

10.1 Dry Contact Communication
The remote interface is a standard feature. Signals are available through a DB9 male connector.

1) AC input present
2) Battery operation
3) Inverter
4) Bypass active
5) Fault
6) Loss of utility

10.2 RS-232C Communication
The RS-232C serial communication interface is available through a DB9 female connector. The interface allows control of the UPS from a personal computer running special Toshiba software.

10.3 EPO Control
The UPS shall come with terminals on its rear side for receiving an Emergency Power Off (EPO) and Remote Run/Stop command from a remote locations.

11.0 Reliability
Demonstrated mean time between failures (MTBF) of 200,000 hours.

12.0 Environment Operation

Operating Ambient Temperature: 0 ~ 40^{o}C (32 ~ 104^{o}F)

Recommended Temperature: +15oC ~ 25oC

Storage Temperature: -20oC ~ 40oC

Humidity: 30-90%, Non-Condensing

Audible Noise: 50dB (A) maximum @ 1 meter from Front Panel

Altitude: 3300 ft (1,000 m) above sea level

13.0 Conformance

UL, CUL, ISO 9001, NEMA/PEI-1993

14.0 Warranty

Toshiba Standard warranty includes 3 Years of on site service which covers electronics and labor, and a 5 year warranty on the batteries (2 years full, 3 years pro-rated)

15.0 Options

15.1 Matching Battery Cabinets

Toshiba UPS offers two matching battery cabinets. Battery runtime may vary based upon: environmental conditions and percentage of load.

kVA	Battery Cabinet	Additional Runtime
3.6	UE31-BC-0650	70 minutes
6.0	UE31-BC-0650	50 minutes
8.0	UE31-BC-1825	75 minutes
10.0	UE31-BC-1825	50 minutes
14.0	UE31-BC-1825	35 minutes
18.0	UE31-BC-1825	25 minutes
22.0	UE31-BC-1825	15 minutes

15.2 Line Cords & Receptacle Panels

To meet diverse electrical distribution requirements, Toshiba provides a wide variety of line cords and receptacle panels to connect various loads to the UPS System.

Line Cord

kVA	Line Cord	Description
3.6	UE31-6LC-30A	L6-30 Plug with 8" Input Line Cord (3 wire)
6.0	UE31-6LC-50A	L6-50 Plug with 8" Input Line Cord (3 wire)
8.0	UE31-8LC-50A	L6-50 Plug with 8" Input Line Cord (3 wire)

Receptacles Panel

kVA	Receptacles	Description
3.6 ~ 6.0	UE3-RP-B3	Four L6-30R, Two 5-15R (Duplex)
3.6 ~ 6.0	UE3-RP-B5	Five 5-20R (Duplex)
3.6~ 6.0	UE3-RP-B7	Two L6-30R, Four 5-15R (Duplex)
8.0	UE3-RP-C5	Five 5-20R (Duplex)
8.0	UE3-RP-C7	Two L6-30R, Four 5-15R (Duplex)

15.3 UPS Built-in Maintenance Bypass

Every Toshiba UPS system includes a thyristor static bypass switch. For applications that require complete isolation of input and output power from UPS system, to allow service personnel to perform routine maintenance and testing without power interruption

to critical power. Toshiba UPS offers an external, wall mounted, 2-breaker maintenance bypass and an internal, cam switch maintenance bypass.

15.4 Remote Monitoring

The UPS contains a communication slot this allows the operator to field install an optional RemotEye II card. The RemotEye II card shall allow the UPS to communicate via Ethernet SNMP, connected directly to the Local Area Network. SNMP/ Web based monitoring – Toshiba UPS system provides comprehensive monitoring of the UPS operation. The optional RemotEye II features an HTTP (web-based) interface for Toshiba UPS. This allows easy access to the Toshiba UPS information from any PC/Network with a web browser.

15.5 Environmental Monitoring Device (EMD)

The EMD is an environmental monitoring device that provides remote monitoring of temperature, humidity and other environmental conditions via standard web browser or network management systems. The EMD provides automated events notification when temperature, humidity or user defined dry contacts is out of configured tolerance.